KITCHEN GARBAGE GRINDERS
THE EFFECT ON SEWERAGE SYSTEMS
AND REFUSE HANDLING

by

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INTRODUCTION

In many major cities of the world there exists a municipal garbage disposal problem (crisis?). One of the most serious components of this problem is the wet food wastes from the kitchen which gives rise to public health and nuisance problems.

Wet kitchen scraps are readily biodegradable. If stored in a warm kitchen (garbage container) they will readily decompose under anaerobic conditions giving rise to bad odours, providing a refuge for flies, cockroaches and bacteria. Most householders will try and get this wet refuse out of the house or apartment as rapidly as possible. But to do this they add it to the remaining dry refuse which is otherwise quite inoffensive and could be easily stored for weeks if necessary.

Those municipalities that have experienced "garbage strikes" are very familiar with the results of bags of rotting garbage being stored in parks, tennis courts and street corners. The rodent population grows and suddenly there is perceived to be a major public health threat.

Any plan for the handling and disposal of municipal wastes that can expect to be successful will **REQUIRE** the separation of these wet putrescible food scraps from the remaining dry generally poorly biodegradable and frequently recyclable refuse.

Most of the woes of the old-fashioned landfill method of garbage disposal results from this small fraction of wet putrescible wastes.

The groundwater contamination from leachate, which is up to 100 times stronger than domestic sewage, originates in this food waste fraction of the garbage. The bacterial decomposition of these food wastes results in a depression of the pH and produces a leachate, that is more acid, and able to readily dissolve heavy metals. The anaerobic digestion process in the landfill produces explosive and some toxic gases rendering large areas of land sterile for many urban or even natural uses. This small fraction of urban waste causes inordinate problems quite out of proportion to their size.

The separation of this putrescible fraction of the waste **must** therefore occur at source. The wet fraction should never be mixed with the dry, inoffensive, easily managed, largely recyclable portion, because once mixed it cannot easily be separated out again.

Today there seems to be only three alternatives available to deal with this wet putrescible garbage stream. These are to:

1. Create and operate a home compost system and recycle the compost to the garden soil during summer months, when the temperature is compatible with the biological composting process.

2. Put out this putrescible fraction for separate curbside pick-up and central or neighbourhood municipal composting, once again subject to appropriate climatic conditions.

3. Grind food waste in a KGG to a size small enough to be washed through the sewerage system to the waste water treatment plant.

All of these solutions place a critical responsibility on each individual householder to perform his/her task in the waste management plan.

Let us examine the alternative strategies for food waste management one at a time:

1. A home compost system requires some management and operational skills concerning what you can and cannot compost, and for regular turning and aeration of the compost. It also requires an ultimate use for the compost produced (e.g. a garden and an interested gardener). It also requires a suitable climate, not too wet, dry, cold or hot.

   This is not a suitable method for apartment dwellers. So even though it appears superficially to be a panacea for the problem it suffers from serious drawbacks.

   It is, however, one solution which should be considered under certain circumstances.

2. Municipal composting of kitchen food wastes once again requires some storage even in the unlikely event of daily pick-up. Storage creates the public health hazards described earlier. Furthermore, the Municipality would be required to operate, aerate, mix and dispose of the compost. This could be quite feasible as most Municipalities have parks where such compost could be used. During the non-growing season the compost would have to be stored and aerated to prevent bad odours, complaints and public health hazards (rodents etc.).

   It is, however, a solution which should be considered and the public health issues should be carefully scrutinized.

3. Disposal of ground kitchen scraps to the sewer and the waste water treatment plant has the advantage that the wet food residues are IMMEDIATELY carried away from the public using devices (KGGs and sewers) and processes (waste water treatment plant) designed for that purpose. This procedure would increase the suspended solids (SS), organic carbon (BOD), nitrogen (N), phosphorus (P) and grease load on the sewerage system and treatment plant. It would also increase to a very small extent the use of water in the household, and therefore the flow of sewage.

This disposal system eliminates kitchen odours and garbage storage problems; it also ensures that the recyclable refuse (newspapers, glass jars, tin cans and plastic) can be stored and handled easily and without contamination. Recyclable materials will be rejected by the market if they are contaminated by organic material.

LITERATURE SURVEY

A household food waste disposer (KGG) is an appliance installed in the kitchen sink to reduce food wastes to small particles and, with the aid of running water, discharge them into a sewerage system. The sewerage system can be a municipally owned system leading to a treatment plant or an individual residential septic tank system.

Years	Units Sold
1950-1959	600,000 Yearly Average
1960-1969	1,000,000 Yearly Average
1970-1973	2,000,000 Yearly Average
1974	2,553,000
1975	2,080,000
1976	2,516,000
1977	2,941,000
1978	3,312,000
1979	3,317,000
1980	2,962,000
1981	3,179,000
1982	2,779,000
1983	3,526,000
1984	4,000,000
1985	4,100,000
1986	4,200,000

Table 1: Units sold and installed (U.S.A. and foreign) (1)

Food waste disposers were introduced in the United States in the 1930's. Their use grew through the years particularly in North America. In recent years their use has become more widespread reaching Australia, Japan and western Europe.(1)

The number of KGGs in use in 1987 has been estimated to be 70 million with 44 million of these in the United States.

The largest manufacturer of KGGs is the American company, Emerson Electric Co., In-Sink-Erator Division, representing about two-thirds of the world's production.

WATER CONSUMPTION

Several studies have examined the incremental increase of water usage. The most recent Swedish study (10) actually demonstrated a reduction of water consumption from 183 l/c/d without disposers to 170 l/c/d with disposers.

References	(2)	(3)	(4)		(5)	(7)
	EPA Study	Bennet & Linstedt	French Study La Rochelle	French Study Nantes	German Study	Nat'l San'n Foundation
Total Household Water Usage gpcpd	45.6	45.0	66.0	66.0	39.6	67.0
lpcpd	172.6	170.0	250.0	250.0	150.0	253.0
KGG Water Usage gpcpd	1.2	0.8	1.12	1.75	1.1	1.14
lpcpd	4.5	3.0	4.25	6.64	4.2	4.3
Percentage of Total Water usage due to KGG use	2.6	1.8	1.7	2.7	2.8	1.7

Table 2 - Water Usage Studies

From Table 2 it can be seen that other studies have determined the additional water usage range from 3.0 to 6.64 lpcpd

WATER USAGE			
Function	gpcpd	lpcpd	% of Total
Toilet Flush	16.2	61	35.5
Bathing	9.2	35	20.2
Clothes Washing	10.0	38	21.9
Dish Washing	3.2	12	7.0
FOOD WASTE GRINDING	1.2	4.5	2.6
Miscellaneous	5.8	22	12.7
TOTAL	45.6	172.6	100

Table 3: Relative water usage of various domestic appliances (2)

The specific breakdown of the various water usages found in the EPA study (2) are shown in Table 3. It can be seen that water savings can be realised by conserving other sources without affecting the use of KGGs.

BOD LOADING

References	(6)	(2)	(4)	(5)	(7)	(10)
	WISCONSIN 1976-84	EPA 1980	FRENCH 1986	GERMAN 1984	NSF 1966	SWEDISH
TOTAL B.O.D.$_5$						
lbs/cap/d	0.12-0.14	0.14	0.12	0.10	0.17	0.16
g/cap/d	54.0-62.0	63.2	0.54 54	45.0	77.0	71.0
B.O.D.$_5$ CONTRIBUTED BY KGG						
lbs/cap/d	NA	0.04	0.07	0.02	0.05	0.07
g/cap/d	NA	18.0	31.0	10.4	23.2	31.0
% OF TOTAL B.O.D.$_5$ CONTRIBUTED BY KGG	-	29.0	57.0	23.0	30.0	44.0

Ave.increase in BOD due to KGG use 0.045 Lbs./Cap/d (20.4 g/cap/d).

Table 4: Summary of household waste water BOD loading studies.

Studies of the contribution of organic carbon (BOD) suggest that an increase of between 23-57% can be expected (Table 4).

A New York study (8) examined older data from 1944 to 1984 and found a similar 29% increase in BOD, whereas a study involving 100 municipalities in the mid-western United States (9) revealed a 22.5% increase in BOD assuming that the entire population were equipped with KGGs (100% market penetration).

SUSPENDED SOLIDS LOADING

References	(6) WISCONSIN 1976-84	(2) EPA 1980	(4) FRENCH 1986	(5) GERMAN 1984	(7) NSF 1966	(10) SWEDISH
TOTAL SS lbs/cap/d	0.14-.15	0.156	0.154	0.088	0.199	
g/cap/d	63-69	70.7	0.70	40.0	90.0	114
SS CONTRIBUTED by KGG lbs/cap/d	NA	0.058	0.075	0.046	0.064	
g/cap/d	NA	26.5	34	20.8	28.9	34
% OF TOTAL SS CONTRIBUTED by KGG -	37.5	48.6	52	32	30	

Ave.increase in SS due to KGG 0.06 lbs/cap/d (28 g/cap/d).

Table 5 - Summary of household waste water "suspended solids" loading studies

Suspended solids have also been studied and indicate an increase of from 30-52% (Table 5) resulting from the use of KGGs..

The incremental contribution of the kitchen disposal unit of course is extremely variable because it is a function of the "normal" value of BOD and SS. This "normal" value varies considerably from municipality to municipality. For example, if one municipality has an average BOD of 90 g/cap/day and another has 40g cap/day, the addition of 29g cap/day from a food waste disposer will have a 32% impact on the former and 73% on the latter.

TREATMENT PLANT DESIGN CAPACITY

The significant point to consider is whether the Municipal waste water is operating at or above design capacity in terms of hydraulic load, BOD load or SS load. Since most water pollution control plants are usually overloaded hydraulically the concentration of both BOD and SS in the incoming waste is usually well below the design value and an additional load would be considered beneficial to improve biological treatment.

For example, many plants nominally operating at capacity (hydraulically) have a BOD of only 100 mg/l although they are typically designed to treat waste with a BOD of 200 mg/l. Thus the incremental addition resulting from food waste disposers would have to be in excess of 100% to overload the system based on BOD. The maximum recorded in the studies cited here has been 57% (4) in Nantes, France.

NUTRIENTS AND GREASE LOADING

The nitrogen and phosphorus contribution to the waste has been reported (2) as 5.3% (N) and 2.5% (P).

Studies of grease contribution by the use of KGGs range from 12.6 - 44.0%. This range suggests unreliable data due to source bias.

REGULATIONS

In the United States, 96.5% of all municipalities permit or require the use of KGGs in residences. Only 3.5% of the municipalities surveyed did not permit the use of such devices.

Status	number of municipalities (percentage) Residential	Commercial	Combined
Not Permitted	30 (3.5%)	50 (6.5%)	34 (4.6%)
Permitted	783 (92.0%)	687 (89.7%)	678 (91.6%)
Required	38 (4.5%)	29 (3.8%)	28 (3.8%)
	851 (100.0%)	766 (100.0%)	740 (100.0%)

Source: American Public Works Association, 1970, Institute for Solid Waste Municipal Refuse Disposal.

Table 6: Regulatory Status of KGGs in cities of the United States

Detailed studies were conducted on three major cities in the United States (8): Los Angeles (City and County), Chicago and Minneapolis. In each case the officials responsible for waste management indicated that the benefits far outweigh the costs.

SWEDISH STUDY (1989-90)

A detailed two year study was conducted in the town of Staffanstorp in Sweden and reported on in January 1990.(10) This study involved the effects of KGGs on the whole system including indoor plumbing, indoor environment (odour noise etc.), transportation through the sewerage system, waste water treatment facilities, sludge treatment, garbage transportation and garbage disposal.

It is one of the most complete studies reported to date, and concluded:

- The kitchen noise level was within acceptable (regulated) levels.
- The KGG was used on average 2.4 times/day for 30 seconds on average.
- No clogging of plumbing or other operational problems were observed.
- TV inspections of the sewers showed the pipes functioned well with no clogging or deposits.
- Water consumption actually reduced from 183 lpcpd without KGGs to 160 lpcpd with disposers. This must be interpreted to mean that there was no discernable increase in water consumption due to KGG use.
- BOD levels increased by 31 g/cap/d.
- COD levels increased by 88 g/cap/d.
- SS levels increased by 34 g/cap/d.
- Total P **decreased** by 0.8 g/cap/d.
- Sedimentation tests showed that the solids settled readily.
- Solid waste (Garbage/Trash) decreased with the use of KGGs from 196 to 160 kg/cap/year. In Sweden this represents an 18% per capita reduction.
- Garbage density decreased from 134 kg/cu.m. to 119 kg/cu.m.
- Moisture content fell from 31 to 25 %.
- Calculations indicated that with the use of KGGs, garbage can be stored for up to 14 days in residential units and up to 2 months in garbage transfer stations.
- User acceptability of KGGs was extremely high (96% satisfied) and the response rate of the survey was also high (81 - 83%)

STUDY PLAN

Although there is considerable data on the acceptability of kitchen garbage grinders (KGG's) in the U.S.A., and a similar data base on their impact on Municipal Water Pollution Control plants, no such studies have been conducted to our knowledge in Canada. A study was therefore undertaken in Penetanguishene, a small Ontario town on the shores of Georgian Bay (Lake Huron).

The purpose of this study was to determine the magnitude of any additional load which might be applied to the sewerage system and waste water treatment facility as a result of the use of KGGs. Such information would be useful to evaluate the benefit/cost ratio of the use of KGGs for the disposal of wet food wastes.

Penetanguishene is a small municipality with a population of some 5000+ people. It is served by two municipally owned and operated sewage treatment plants employing the contact stabilization process. The operating records for the first phase of the plant date back to 1966. The plants have been made available to the University of Toronto for research purposes.

Town Council agreed to permit KGG's to be installed in one section of the Town to monitor any differences in the quality of sewage resulting from the use of these appliances.

The sewage collection system consists almost entirely of separate storm and sanitary sewers. The trunk sewer network permitted the isolation of one area for monitoring purposes. This area is shown on the map (Figure 1) includes approximately 180 homes. The sewage from this area was monitored for 30 days and then KGG's were made available at no cost to those homes wishing to take part in this study.

The parameters which were monitored included BOD_5 (Biochemical Oxygen Demand), SS (Suspended Solids), N (Total nitrogen) and P (Total phosphorus). By comparing these parameters before and after the introduction of KGG's it is possible to predict the impact on the sewerage system. At the same time, the municipal garbage from the study area was weighed separately to determine any changes in the garbage collected before and after the installation of KGG's.

With the area selected as described above, "In-Sink-Erators" (KGGs) were made available at no cost to each of the 180 homes in the designated area. In addition $75 was provided to those volunteering to take part in the study to partially offset the cost of installation.

Surprisingly only 45 homes took advantage of this offer. This number however is adequate to evaluate the impact of KGGs at 25% market penetration. These units were duly installed and inspected to ensure proper operation and to ensure that the householders were fully instructed on the correct use of the food waste disposer.

With only 25% of the possible homes being served by these appliances it was expected that no more than 25% of the expected 40-50% increase in BOD and SS would be observed.

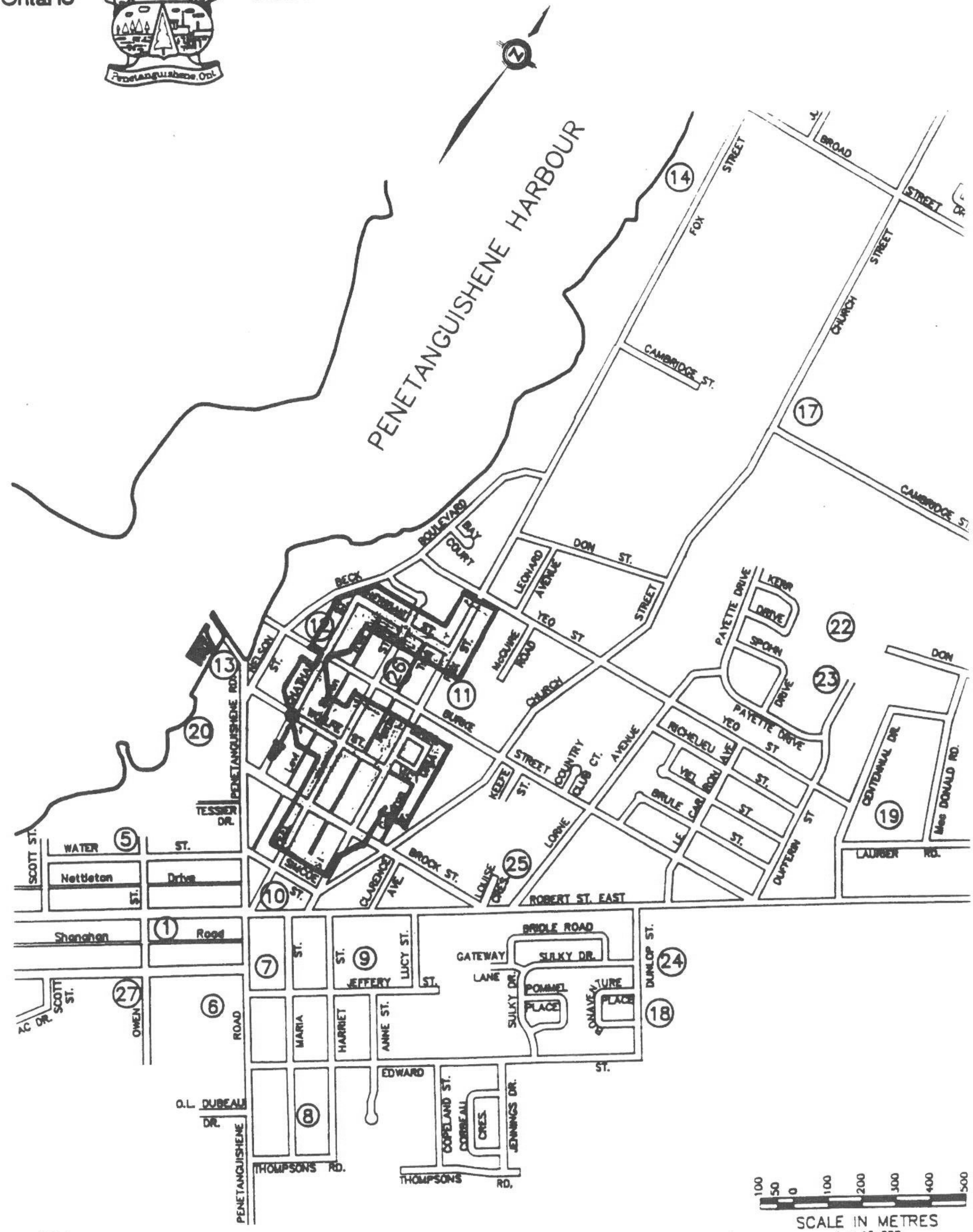
This 10-12% increase, if found, should be statistically significant and detectable.

RESULTS

Table 7 shows the data prior to the installation of these KGGs. It is of interest to note that the 180 homes actually contributed 25% of the total flow reaching the plant during the study period, 8 March to 10 April 1990. By examining the total flow at the plant during this period it can be seen that the hydraulic load exceeded the design capacity (0.800 USMGD) on all but 5 days. This suggests that illegal connections and house weeping tiles were contributing ground water for much of the study period. This fact is borne out by the very low BOD concentrations, averaging only 37.0 mg/l.

PENETANGUISHENE

Ontario Canada



	TotP mg/l	PFlux kg/d	SS mg/l	SFlux kg/d	BOD mg/l	BFlux kg/d	TKN mg/l	NFlux kg/d	Stdy Flow m³/hr	% of MainFlo
Average	3.0	2.7	85	76.0	37	32.7	8.4	7.5	37.2	25.1
Maximum	9.1	7.3	447	514.1	115	59.7	18.2	16.4	56.3	31.6
Minimum	0.6	0.8	10	13.2	8	7.7	1.0	0.1	16.5	11.8
St.Dev'n	2.1	0.5	79	19.5	24	5.8	5.0	1.2	10.2	5.2

Table 7: Flow and Waste Water strength before installation of KGGs

Table 8 shows the results of the same data after the installation of food waste disposers in 25% of the homes.

	TotP mg/l	PFlux kg/d	SS mg/l	SFlux kg/d	BOD mg/l	BFlux kg/d	TKN mg/l	NFlux kg/d	Stdy Flow m³/hr	% of Mainflo
Average	1.6	0.6	107	47.4	45	19.8	12.0	4.7	15.5	18.2
Maximum	3.0	1.4	280	132.5	100	47.3	20.0	9.5	18.2	22.2
Minimum	0.8	0.4	47	18.8	20	7.5	5.6	2.5	9.4	10.4
Std. Dev'n	0.8	0.4	62	31.1	23	10.9	4.8	2.6	2.1	2.5

Table 8: Flow and Waste Water strength after installation of KGGs

The data in tables 7 and 8 are presented in the form of both concentration of the average daily sample (mg/l) and flux of the material being monitored. The flux is the product of the concentration and the flow, and is expressed as kilograms/day (kg/d).

The data are compared in this way because with a combined sewer which may be carrying excess storm water, the concentration of the parameter under consideration may be reduced simply due to dilution. However the larger volume of more dilute waste water will still carry the same amount of waste and the flux is a measure of the total amount of contaminant being transported. In this way we are able to compare the actual amount of SS, P, BOD and N carried by the sewer both before and after the installation of KGGs.

Table 9 shows the increase or (reduction) in P, SS, BOD and TKN (Total Nitrogen) both in terms of concentration and flux. It is interesting to note that in all but one case (P) the concentration of the parameters measured increased, but in every case the flux of P, SS, BOD and TKN actually reduced after the installation of KGGs.

It may also be noted that the flows in the study period prior to the installation of KGGs was on average more than double the flow in the late summer, following the KGG installations.

	Conc. Difference	Flux Difference
Phosphorus (P)	(1.4)	(2.1)
Suspended Solids (SS)	22.0	(28.6)
BOD	8.0	(12.9)
TKN	3.6	(2.8)

Table 9: Increase (Reduction) in sewage strength
Before and after installation of KGGs

The study area was isolated by the garbage haulage contractor and a separate "pick up" route was instituted. The garbage hauled from the study area was weighed and recorded separately at the transfer station.

Table 10 shows the quantity of garbage picked up on a weekly basis from this 180 home area both before and after the installation of disposers.

The reduction in garbage weight is small, less than 2%, however any variations in garbage collected between these two study periods would be masked by the garden refuse resulting from the fall gardening activities.

Date	Weight collected (kgs.) Before Installation	After Installation
25 April 90	2640	
02 May	2350	
09 May	2390	
16 May	2380	
12 September		2520
26 September		2320
03 October		2340
Averages	2440	2393

Table 10: Comparison of garbage collected before and after installation of grinders

Question	Response	%
1. What do you like about having a food waste disposer in your home ?	Reduces volume of garbage	71
	Reduces odours	13
	Convenience & ease of handling	39
2. Does the disposer get used regularly ?	Yes	95
3. Does everyone in the family use it ?	yes	88
4. If you moved would you install a food waste disposer in your new kitchen ?	yes	95
5. Do you recommend them to people who do not have one ?	yes	95
6. Do you feel that a food waste disposer is a benefit		
- to your home	yes	95
- to the environment	yes	39
	(remainder awaiting results of study)	
7. Do you have any concerns about your food waste disposer ?	no	71

Table 11: Survey of participants in the study

A survey of participants (Table 11) indicated that everyone was extremely pleased with their new acquisitions. One participant indicated that he had put out no garbage since the installation of a kitchen garbage grinder. This meant of course that most of his residual garbage was entirely recyclable in his blue box* .

OPERATION OF THE WATER POLLUTION CONTROL PLANT

From 1985 figures (11) it has been shown that 4000 people contribute to the flow to the Main Street WPC Plant. It would not be expected that the 45 homes (135-180 persons) would represent a serious problem to the operation of the water pollution control plant. This in fact proved to be the case, and no impact whatsoever was detected in the operation of the WPC Plant.

Note: * In Ontario a Blue Box is provided to each home in participating areas to take recyclable goods. This is an Ontario initiative intended to encourage recycling and separation at source in an attempt to reduce the quantity of municipal refuse to be disposed of.

IMPACT ON WATER SUPPLY

The municipal water supply in Penetanguishene is charged out at a flat rate with the exception of some major water users (industries) which are metered. The flow variation resulting from the use of KGGs was therefore not detectable. Total water production figures would not be helpful because significant variation resulted from higher summer consumption during the "after installation" period.

There is no statistically significant difference that can be attributable to the use of food waste disposers. This is consistent with the results of others who have found insignificant increases in water usage attributable to the use of food waste disposers.

CONCLUSIONS

1. There was no detectable impact on the flow or quality of the sewage reaching the water pollution control plant.

2. Although a very small reduction in garbage picked up in the study area was observed (1.9%) this was probably not statistically significant. The seasonal variation in garbage picked up in April/May and September/October would have masked any real variation due to the installation of KGGs.
   The survey of participants did however indicate that there was a real difference in the quality of the refuse.

3. The quantity and quality of sewage flowing through the monitored section did not indicate that the installation of KGGs had any impact whatsoever.

4. There was no detectable impact on the Water Supply

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APPENDICES

A. Detailed Sewage Study Data

1. Before the installation of KGGs.

2. After the installation of KGGs

B. User survey of KGGs.

C. Raw data from Transfer Station Weigh Scale

KITCHE N GARBAGE GRINDER STUDY - PART 1 - PRIOR TO INSTALLATION OF KGGs.

DATE	Suspen	Solid	Total	Phosph	Tota	BOD	Tot. N	Efflue	Flow	Efflue	Flow	Stdy as	USMG	SS	Flux	P	Flux	BOD	Flux	N Flux
	mg./ l.		mg./ l.		mg./ l.		mg/l	cu.m	/hour	Thous	cu.m./d	% of	Main	Stdy A	Mn Pln	Stdy A	Mn Pl	Stdy A	Mn Pl	Stdy A
	Stdy A	Mn Pl	Stdy A	Mn Pl	Stdy A	Mn Pl	Stdy A	Stdy A	Mn Pl	Stdy A	Mn Pla	Totflo	Plant	kg/d	kg/d	kg/d	kg/d	kg/d	kg/d	kg/d
08-Mar-90								16.5	115.1	0.396	2.763	14.33	0.730	0.00		0.00	0.00	0.00	0.00	0.00
09-Mar-90								18.7	116.7	0.449	2.801	16.02	0.740	0.00		0.00	0.00	0.00	0.00	0.00
10-Mar-90	123		4.20	3.75	115		18.2	19.1	127.8	0.458	3.066	14.95	0.810	56.33		1.92	11.50	52.67	0.00	8.34
11-Mar-90	67		3.48	6.10	100		14.0	23.9	203.5	0.574	4.883	11.75	1.290	38.46		2.00	29.79	57.40	0.00	8.04
12-Mar-90	75		2.49	3.30	50		7.1	49.7	216.1	1.193	5.186	23.00	1.370	89.48		2.97	17.11	59.65	0.00	8.47
13-Mar-90	33		0.56	1.72	20		4.4	56.3	178.2	1.351	4.278	31.59	1.130	44.58		0.76	7.36	27.02	0.00	5.94
14-Mar-90	10		0.72	2.40	10		4.1	54.8	189.3	1.315	4.542	28.95	1.200	13.15		0.95	10.90	13.15	0.00	5.39
15-Mar-90	21		1.71	1.18	20		0.1	53.0	183.0	1.272	4.391	28.97	1.160	26.71		2.18	5.18	25.44	0.00	0.13
16-Mar-90	49		2.73	1.98	20		0.1	49.6	171.9	1.190	4.126	28.85	1.090	58.31		3.25	8.17	23.80	0.00	0.12
17-Mar-90	447		1.40	2.55	16		2.7	47.9	168.8	1.150	4.050	28.38	1.070	514.05		1.61	10.33	18.40	0.00	3.11
18-Mar-90	125		2.20	2.20	28		9.1	44.5	159.3	1.068	3.823	27.93	1.010	133.50		2.35	8.41	29.90	0.00	9.72
19-Mar-90	84		2.20	2.00	22		7.7	42.2	143.5	1.013	3.445	29.40	0.910	85.09		2.23	6.89	22.29	0.00	7.80
20-Mar-90	93	5	2.70	3.00	24	59	6.8	40.6	138.8	0.974	3.331	29.25	0.880	90.58	16.66	2.63	9.99	23.38	196.54	6.62
21-Mar-90	90	97	2.70	2.95	28	62	6.3	40.9	135.6	0.982	3.255	30.15	0.860	88.38	315.78	2.65	9.60	27.50	201.84	6.19
22-Mar-90	24	121	2.30	3.20	28	98	9.0	44.2	148.3	1.061	3.558	29.81	0.940	25.46	430.55	2.44	11.39	29.71	348.71	9.55
23-Mar-90	94	59	2.30	1.70	30	38	4.1	43.2	145.1	1.037	3.483	29.77	0.920	97.48	205.47	2.39	5.92	31.11	132.34	4.25
24-Mar-90	33	215	2.50	2.75	26	105	6.9	40.2	135.6	0.965	3.255	29.64	0.860	31.85	699.92	2.41	8.95	25.09	341.82	6.66
25-Mar-90	43	418	7.70	2.65	34	116	17.4	39.3	127.8	0.943	3.066	30.76	0.810	40.55	1281.66	7.26	8.13	32.06	355.68	16.41
26-Mar-90	169	298	7.50	2.25	34	130	18.1	31.6	127.8	0.758	3.066	24.73	0.810	128.10	913.72	5.69	6.90	25.77	398.60	13.72
27-Mar-90	51	67	9.10	2.25	42	70	17.8	28.2	126.2	0.677	3.028	22.35	0.800	34.53	202.90	6.16	6.81	28.43	211.98	12.05
28-Mar-90	71	264	5.30	2.75	42	129	11.1	27.3	132.5	0.655	3.180	20.61	0.840	46.51	839.45	3.47	8.74	27.51	410.19	7.27
29-Mar-90	148	103	5.40	2.50	54	91	9.1	27.0	121.4	0.648	2.915	22.23	0.770	95.90	300.22	3.50	7.29	34.99	265.24	5.90
30-Mar-90				2.85		118		26.8	132.5	0.643	3.180	20.23	0.840	0.00		0.00	9.06	0.00	375.21	
31-Mar-90	62	160	1.59	3.15	34	94	9.6	27.0	126.2	0.648	3.028	21.40	0.800	40.18	484.53	1.03	9.54	22.03	284.66	6.22
01-Apr-90	124		3.42	3.05	70	111	11.9	28.2	124.6	0.677	2.990	22.63	0.790	83.95		2.32	9.12	47.39	331.94	8.06
02-Apr-90	80	324	1.71	3.25	36	106	9.9	37.9	175.1	0.910	4.202	21.65	1.110	72.80	1361.39	1.56	13.66	32.76	445.39	9.01
03-Apr-90	60	61	1.15	1.65	32	32	6.2	42.9	164.0	1.030	3.937	26.15	1.040	61.80	240.15	1.18	6.50	32.96	125.98	6.39
04-Apr-90	62	46	2.00	1.70	28	32	7.7	43.2	157.7	1.037	3.785	27.39	1.000	64.29	174.13	2.07	6.44	29.04	121.13	7.98
05-Apr-90	42	43	1.88	1.75	8	43	7.0	39.9	145.1	0.958	3.483	27.50	0.920	40.24	149.75	1.80	6.09	7.66	149.75	6.71
06-Apr-90	46	57	2.09	2.65	40	61	9.4	38.3	137.2	0.919	3.293	27.91	0.870	42.27	187.72	1.92	8.73	36.76	200.89	8.64
07-Apr-90	60	100	1.27	2.85	36	78	7.0	37.1	129.3	0.890	3.104	28.69	0.820	53.40	310.40	1.13	8.85	32.04	242.11	6.23
08-Apr-90				2.80		94		35.9	124.6	0.862	2.990	28.81	0.790	0.00		0.00	8.37	0.00	281.10	0.00
09-Apr-90				2.85		158		36.5	138.8	0.876	3.331	26.30	0.880	0.00		0.00	9.49	0.00	526.32	0.00
10-Apr-90								31.3	157.7	0.751	3.785	19.84	1.000	0.00		0.00	0.00	0.00	0.00	0.00
Average	85	122	3.01	2.64	37	87	8.4	37.2	147.8	0.892	3.547	25.06	0.937	76.02	432.39	2.69	9.35	32.72	308.26	7.47
Maximum	447	418	9.10	6.10	115	158	18.2	56.3	216.1	1.351	5.186	31.59	1.370	514.05	1361.39	7.26	29.79	59.65	526.32	16.41
Minimum	10	5	0.56	1.18	8	32	1.0	16.5	115.1	0.396	2.763	11.75	0.730	13.15	16.66	0.76	5.18	7.66	0.00	0.12
Std Devn.	79	118	2.10	0.86	24	34	5.0	10.2	25.1	0.245	0.602	5.18	0.159	19.45	70.72	0.52	0.52	5.76	20.67	1.23

Kitchen Garbage Grinder Study Part 1 prior to the installation of KGGs b:\ise\kgg1.wk1 13 December 1990

KITCHE N GARBAGE GRINDER STUDY - PART 2 - FOLLOWING INSTALLATION OF KGGs

DATE	Suspe mg l.	Soli	Tota Phosp mg l.		Tot BOD mg l.		Tota mg/l	N mg/l	Efflue cu.m./	Flow Hour	Efflue Thous	Flow cu.m./d	Stdy as % of	USMG Main	SS	Flux	P	Flux	BOD	Flux	N	Flux
	Stdy	Mn	Stdy	Mn	Stdy	Mn	Stdy	Mn	Stdy A	Mn Pl	Stdy A	Mn Pla	Totflo	Plant	Stdy A kg/d	Mn Pl kg/d	Stdy kg/d	Mn kg/d	Stdy A kg/d	Mn Pl kg/d	Stdy A kg/d	Mn kg/d
16-Oct-90	60	190	1.5	1.6	30	130	9.1	17.0	18.16	113.6	0.436	2.725	15.99	0.720	26.15	517.84	0.65	4.36	13.08	354.31	3.97	46.33
17-Oct-90	180		1.4		40		10.0		22.22	132.5	0.533	3.180	16.77	0.840	95.99		0.75		21.33		5.33	
18-Oct-90	120		0.91		50		13.0		19.13	143.5	0.459	3.445	13.33	0.910	55.09		0.42		22.96		5.97	
19-Oct-90	62	120	0.81	1.20	20	40	5.6	12.0	18.50	127.8	0.444	3.066	14.48	0.810	27.53	367.94	0.36	3.68	8.88	122.65	2.49	36.79
20-Oct-90	110	120	1.10	1.80	30	70	12.0	15.0	18.16	116.7	0.436	2.801	15.56	0.740	47.94	336.14	0.48	5.04	13.08	196.08	5.23	42.02
21-Oct-90	100	110	1.00	2.10	40	60	10.0	16.0	18.29	115.1	0.439	2.763	15.89	0.730	43.90	303.97	0.44	5.80	17.56	165.80	4.39	44.21
22-Oct-90		130		2.00		70		19.0	21.27	116.7	0.510	2.801	18.22	0.740		364.16		5.60		196.08		53.22
23-Oct-90	73	87	1.70	3.80	50	100	15.0	19.0	17.68	107.3	0.424	2.574	16.48	0.680	30.98	223.94		9.78	21.22	257.41		48.91
24-Oct-90	120	140	2.80	2.00	50	130	18.0	17.0	19.30	112.0	0.463	2.688	17.23	0.710	55.58	376.27	1.30	5.38	23.16	349.39	8.34	45.69
25-Oct-90	47	150	1.50	4.50	40	120	9.8	17.0	16.66	108.8	0.400	2.612	15.31	0.690	18.79	391.79	0.60	11.75	15.99	313.43	3.92	44.40
26-Oct-90	110	140	1.50	3.30	30	110	13.0	17.0	10.40	110.4	0.250	2.650	9.42	0.700	27.46	370.97	0.37	8.74	7.49	291.48	3.24	45.05
27-Oct-90	100	170	2.50	3.30	70	70	15.0	17.0	16.78	119.9	0.403	2.877	14.00	0.760	40.27	489.08	1.01	9.49	28.19	201.38	6.04	48.91
28-Oct-90	130	160	2.00	2.90	60	110	12.0	16.0	17.62	115.1	0.423	2.763	15.30	0.730	54.97	442.14	0.85	8.01	25.37	303.97	5.07	44.21
29-Oct-90	120	100	2.20	3.00	70		17.0	15.0	18.73	110.4	0.450	2.650	16.96	0.700	53.94	264.98	0.99	7.95	31.47		7.64	39.75
30-Oct-90	280	150	3.00	2.80	100		20.0	31.0	19.72	110.4	0.473	2.650	17.86	0.700	132.52	397.47	1.42	7.42	47.33		9.47	82.14
Average	107	136	1.59	2.45	45	92	12.0	15.2	18.17	117.3	0.436	2.816	15.52	0.744	47.41	323.11	0.64	6.20	19.81	183.47	4.74	41.44
Maximum	280	190	3.00	4.50	100	130	20.0	31.0	22.22	143.5	0.533	3.445	18.22	0.910	132.52	517.84	1.42	11.75	47.33	354.31	9.47	82.14
Minimum	47	87	0.81	1.20	20	40	5.6	12.0	10.40	107.3	0.250	2.574	9.42	0.680	18.79	223.94	0.36	3.68	7.49	122.65	2.49	36.79
Std Devn.	62	28	0.78	1.11	23	29	4.8	7.2	2.53	9.7	0.061	0.232	2.10	0.061	31.06	146.34	0.40	3.25	10.94	127.69	2.60	19.05

IN-SINK-ERATOR
NEWS RELEASE
In-Sink-Erator Division, Emerson Electric Co.
PO Box 150, Markham, Ontario Canada L3P 3J6

TOWN OF PENETANGUISHENE MUNICIPAL SOLID WASTE EXPERIMENT

As part of a study on the impact of food waste disposers on the sewage treatment facilities in the Town of Penetanguishene a questionnaire was given to each household containing seven general questions about food waste disposers.

The response was extremely positive:

QUESTION		RESPONSE
1.	What do you like about having a food waste disposer in your home?	Reduces volume of garbage 71% Reduces unpleasant odors 13% Convenience & ease of handling 39%
2.	Does the food waste disposer get used regularly?	Yes - 95%
3.	Does everyone in the family use it?	Yes - 88%
4.	If you moved, would you install a food waste disposer in your new kitchen?	Yes - 95%
5.	Do you recommend them to people who don't have one?	Yes - 95%
6.	Do you feel that a food waste disposer is a benefit	
	- to your home?	Yes - 95%
	- to the environment?	Yes - 39% (Remainder waiting for results of study)
7.	Do you have any concerns about your food waste disposer?	No - 71%

OCTOBER 1990

TOWN OF
PENETANGUISHENE
10 ROBERT STREET WEST
P.O. BOX 560 LOK 1P0

TELEPHONE
(705) 549 - 7453

ONE SIXTY UNITS SURVEY

DATE	MATERIAL CLASS	NET	WEIGH SCALE RECEIPT
April 25, 1990	03	2640 Kg.	20534
May 02, 1990	03	2350 Kg.	20924
May 09, 1990	03	2390 Kg.	21265
May 16, 1990	03	2380 Kg.	21568

Sept. 12,1990	03	2520 kg.	27632
Sept. 26,1990	03	2320 kg.	28172
Oct. 3, 1990	03	2340 kg.	28450